REMARKS:

1) Referring to item 10) of the Office Action Summary, the Examiner is respectfully requested to indicate the acceptance of the drawings originally filed on October 18, 2004, and the Replacement Sheet filed on November 21, 2005.

2) Referring to item 12) of the Office Action Summary, the Examiner is respectfully requested to acknowledge the Priority Claim, and receipt of the certified copy, through the PCT processing of this application.

3) Referring to the top of page 2 of the Office Action, the election of Species A and associated claims 1 to 27 and 31 is affirmed. The non-elected claims 28 to 30 remain withdrawn, but depend from generic claim 12. Thus, if claim 12 is ultimately found allowable, the Examiner is respectfully requested to rejoin, consider and allow the non-elected dependent claims 28 to 30.

4) The claims have been amended as follows. Claims 10, 11 and 12 have been amended to recite additional inventive features regarding the spatial pattern of the perforations such that flow disturbances generated by the perforations will cause mutual destructive interference with one another. This feature is supported in the original application (for example claims 1 and 25) and does not introduce any new matter. Dependent claim 25 has been amended for conformance with the amended independent

parent claim. Entry and consideration of the claim amendments are respectfully requested.

5) As a preliminary matter, it is noted that this application is the national stage of corresponding PCT International Application PCT/US2003/012008. For the PCT application, the USPTO acted as International Preliminary Examining Authority, and examined the original claims 1 to 31 of this application. On October 31, 2005, the USPTO acting as International Preliminary Examining Authority issued the International Preliminary Examination Report, in which the US Examiner indicated that at least claims 1 to 11, 13 to 15, 25 to 27 and 31 satisfied all criteria for patentability, including novelty, inventive step (or non-obviousness) and industrial applicability (or utility). As it was a US Examiner of the USPTO acting as the International Preliminary Examining Authority who examined the claims and issued the International Preliminary Examination Report, this patentability determination should be given full faith and credit in the further national stage prosecution of this PCT application. For example, see 37 C.F.R. 1.496(b). Also, MPEP 1893.03(e) expressly states that the Examiner of the national stage application shall take the PCT Report on Patentability by the IPEA into consideration for the national stage examination, and should expressly indicate in the first Office Action that the PCT Report on Patentability by the IPEA has been so considered. The present first Office Action does not include any such indication, and it appears that the Examiner may

not have taken the International Preliminary Examination Report into consideration.

6) Before particularly addressing the prior art rejections, and comparing the claimed features of the invention to the prior art reference disclosures, the invention will first be discussed in general terms to provide a background.

The present invention is generally directed to a laminar flow control apparatus that may be used to control the laminar flow of the boundary layer airstream flowing along an outer surface of an airfoil such as an aircraft wing. It is generally known that the laminar flow conditions of the boundary layer of air flowing over an aircraft wing can be influenced by sucking some of the boundary layer air through holes or perforations provided in the skin of the wing.

The present invention is especially directed to the arrangement of perforations that are spatially distributed in a specially designed spatial pattern so that flow disturbances created by the air suction through the several perforations will undergo mutual destructive interference with one another and thereby at least partially cancel each other out. Thus, it is a special feature of the invention, that the perforations are arranged in a particular spatial pattern of the perforations that causes mutual destructive interference of the flow disturbances caused by suction through the perforations. With such mutual destructive interference, the flow disturbances respectively created by suction through the respective perforations will mutually cancel each other out or reduce each other at flow

wavelengths that are characteristic of the arising boundary layer flow, preferably the wavelengths of the most unstable disturbances appearing in the boundary layer flow. In this regard, please see the original pecification at page 7 lines 5 to 19, page 14 lines 16 to 19, page 15 line 20 to page 18 line 21, page 19 lines 11 to 16, etc.

In order to achieve this inventive feature, the perforations are positioned in a proper spatial pattern so as to purposely cause the mutual destructive interference of the flow disturbances respectively caused by suction through the several perforations, at one or more selected wavelengths that are determined by the spatial pattern as well as the dimensions and spacing of the respective perforations (see the Specification at page 13 line 15 to page 18 line 21, and Figs. 6, 7, 6A, 7A and 9). These predetermined wavelengths are chosen to match the wavelengths of predetermined flow instabilities appearing in the boundary layer. As a result of the inventive destructive interference among the flow disturbances created by the several perforations, there is essentially no energy in the flow at the selected predetermined wavelengths of the flow instabilities. Thus, the action of the suction through the perforations will generate a minimum excitation of flow instabilities at the pertinent wavelengths in the boundary layer stream flowing along the perforated skin (see the specification at page 18 lines 12 to 21).

No teachings of the prior art have disclosed or suggested arranging perforations in such a particular spatial pattern so as to cause mutual destructive interference among the flow

disturbances generated by the perforations. The prior art would not have provided any suggestion, motivation, teaching, incentive, or purpose for arranging the perforations in such a specially designed pattern, as will be discussed below.

7) Referring to pages 2 and 3 of the Office Action, the rejection of claims 1 to 6 and 10 to 24 as anticipated by or obvious over US Patent 3,951,360 (Anxionnaz) is respectfully traversed.

In order to anticipate a claim, a prior art reference must disclose or inherently include all features recited in the claim. That is not the case here.

Contrary to the Examiner's bald unsupported assertion, Anxionnaz does not disclose that the perforations are spatially distributed in a spatial pattern of the perforations such that flow disturbances generated by the perforations undergo mutual destructive interference at least at one or more selected wavelengths. If the Examiner believes that there is such a disclosure in the reference, the Examiner is respectfully requested to point out the column and line of such disclosure. No such disclosure can be found in the reference. To the contrary, Anxionnaz expressly discloses that the perforations are distributed depending on the local thickness and the distribution of energy in the thickness of the boundary layer (col. 1 lines 37 to 45, col. 2 line 65 to col. 3 line 30, etc.). Such a motivation, to arrange the perforations dependent on the thickness of the local boundary layer, has nothing to do with arranging the perforations in a spatial pattern such that flow disturbances respectively generated by the several perforations

will undergo mutual destructive interference with one another as these flow disturbances propagate over the perforated skin surface.

The present inventive feature also would not have inherently existed in the subject matter disclosed by Anxionnaz. In order to be inherent, a feature must **necessarily** be present in the prior art structure, and the Examiner must provide a detailed explanation citing the specific text portions of the reference demonstrating that the feature necessarily exists. The **mere possibility** or even the **probability** that the feature exists in the prior art structure is **not** sufficient to support inherency. The Examiner has provided no explanation of inherency, and the inventive feature would not inherently have been present in the prior art.

To the contrary, the arrangement and spatial distribution and dimensions of the perforations disclosed by Anxionnaz would have been entirely **unsuitable** for producing mutual destructive interference of flow disturbances at any flow wavelengths pertinent for the wing of an aircraft in flight as disclosed by Anxionnaz. As explained in the present application (see page 7 lines 14 to 19, page 14 lines 11 to 19, etc.) a pertinent size range of micro-slots as the perforations involves a width in a range of 50 to 250 μm and a length in a range of 100 to 3000 μm, in connection with the pertinent range of flow wavelengths. Contrary thereto, Anxionnaz uses perforations having a length of about 7 mm (= 7000 μm) (col. 5 line 5). Such a huge slot length is not suitable for creating mutual destructive interference in the airflow over an aircraft wing. Even more importantly, the

relative spacing between the rows (R', R", etc.) of slots (3) as shown in Figs. 1, 2, 4 and 5, in the airflow direction, i.e. in the direction perpendicular to the longitudinal extension of the slots and the rows thereof, is especially too large to produce the inventive mutual destructive interference. For example, in Fig. 4 of the reference it is apparent that the closest lateral spacing of the slots is several times the skin thickness of the aircraft wing skin, and as shown in Fig. 5 the lateral spacing of the rows is greater than the longitudinal length of each slot. Such a huge spacing in the flow direction between adjacent rows of slots is not able to create mutual destructive interference, as explained and developed in the present application in connection with Figs. 7, 7A and 9 and the specification at pages 11 to 18.

For the above reasons, a person of ordinary skill in the art would have found no teaching, suggestion, motivation, incentive or purpose for changing the slot size, spacing and pattern disclosed by Anxionnaz in such a manner that would have provided a mutual destructive interference of the flow disturbances respectively created by the several perforations. There is simply no consideration (and certainly no suggestions or motivations) given to such destructive interference of flow disturbances, whatsoever, in the teachings of Anxionnaz.

The Examiner has blankly asserted (without any support whatsoever) that "*Anxionnaz's system is CAPABLE OF producing flow disturbances that undergo mutual destructive interference at least at one or more selected wavelengths*" (emphasis added). This assertion is respectfully traversed. First of all, for the

reasons explained above, it is clear that Anxionnaz's system is **NOT capable of** producing flow disturbances that undergo mutual destructive interference at any flow wavelengths pertinent for an aircraft wing. Secondly, even if a prior art arrangement might be "capable of" achieving an inventive feature, that is not a substitute for a prior art teaching, suggestion or motivation to proceed in that manner, and also does not demonstrate that such a feature is necessarily and thus inherently present in the prior art structure. The spatial pattern of perforations according to Anxionnaz is not capable of the inventive features without being modified, i.e. without being particularly designed to achieve the inventive feature as taught in the present application. Nothing in the disclosure of Anxionnaz would have taught, motivated or enabled a person of ordinary skill to design the spatial pattern of perforations in such a manner.

Each of the rejected independent claims 1, 10, 11 and 12 respectively defines features of the invention as discussed above, relating to the special spatial pattern of the perforations such that the flow disturbances created by the perforations will undergo mutual destructive interference with each other. For the above reasons, the independent claims are not anticipated by, and would not have been obvious over, the teachings of Anxionnaz. The dependent claims recite additional features that further distinguish the invention over the prior art, for example as follows.

The reference provides no disclosures or suggestions regarding the features of present claims 2 and 3, contrary to the Examiner's unsupported assertions.

Claim 4 expressly recites that the selected wavelengths correspond to flow wavelengths of predetermined flow instabilities appearing in the boundary layer airstream. Anxionnaz has nothing to do with this feature. Similar considerations apply to claim 5.

Claim 6 recites that the perforations are micro-slots having a length of 100 to 3000 μm and a width of 50 to 250 μm. Contrary thereto, the slots according to Anxionnaz have a length of 7000 μm (col. 5 line 5), which makes them significantly too big to achieve the inventive feature of mutual destructive interference of flow disturbances, as discussed above. The Examiner's assertion that the size of the slots would be optimized by mere routine efforts "*to reduce drag and improve maneuverability*" are not motivated by anything in the disclosure of Anxionnaz, but are simply a post-hoc rationalization provided by the Examiner as a hindsight reconstruction of the present invention. Particularly, the motivation of Anxionnaz is to produce a size and pattern of slots that will suck away a proper portion of the boundary layer depending on the local thickness of the boundary layer (col. 1 lines 37 to 45). Optimizing the slot sizes for such a purpose would not have led to an optimization of the slot sizes for the very different feature of the invention, namely to produce mutual destructive interference among flow disturbances created by the slots. Similar considerations regarding the significantly different size disclosed by Anxionnaz apply to present dependent claims 13 to 15.

Contrary to present claim 17, Anxionnaz does not disclose elongated slots having a long axis oriented perpendicular to the longitudinal extension direction of the respective bundle of slots (see Fig. 5 of Anxionnaz). The reference is similarly contrary to present claim 18. Similar considerations apply to present claim 19 and 21.

Regarding present claim 23, Anxionnaz does not disclose or suggest different row groups that have different characteristics such as different lengths, widths, orientations, spacings, periodicities, staggerings, numbers, or patterns of the perforations. Contrary thereto, each row has a regular and repetitive set of characteristics of the slots (see Fig. 5 of Anxionnaz).

Contrary to present claim 24, the perforations according to Anxionnaz do not have a circular cross-section, but rather an arc-shaped cross-section. A hole with a circular cross-section would not provide the "counter-ramming" effect intended by Anxionnaz.

For the above reasons, the Examiner is respectfully requested to withdraw the rejection of claims 1 to 6 and 10 to 24 as anticipated by or obvious over Anxionnaz.

8) Referring to the bottom of page 3 of the Office Action, the rejection of claims 1 to 23, 25 to 27 and 31 as anticipated by or obvious over US Patent 6,216,982 (Pfennig et al.) is respectfully traversed.

The above general discussion of the invention and the claimed features thereof is pertinent here as well.

In order to anticipate a claim, a prior art reference must expressly disclose or inherently include all features recited in the claim. That is not the case here. Pfennig et al. do not disclose any particular pattern of perforations whatsoever, and especially do not disclose such a spatial pattern of perforations that will cause mutual destructive interference of flow disturbances generated by the perforations in the airflow. To the contrary, Pfennig et al. are not at all concerned with the pattern or arrangement of the perforations. The reference expressly states that the construction and configuration of the perforations can be in accordance with any known arrangements for achieving a boundary layer control by sucking boundary layer air through the perforations (col. 4 lines 36 to 42). Such broad generalized teachings merely referring to the known state of the art are not a disclosure of the presently claimed inventive spatial pattern of perforations, because the Examiner has not shown such a spatial pattern to exist in the prior art. Also, such general teachings do not demonstrate that the claimed inventive spatial pattern must necessarily exist in the prior art arrangement, so that the inventive feature is not inherent.

Also, the present inventive feature of arranging the perforations in such a spatial pattern so that the flow disturbances created by the perforations will undergo mutual destructive interference, would not have been obvious from the reference, because Pfennig et al. would have provided no teachings, suggestions, or motivations in this regard, whatsoever. The disclosure of Pfennig et al. especially relates to a suction generator using a jet pump (7) for creating the

suction airflow to suck air through the perforated or porous suction areas (3) of the wing. Pfennig et al. do not disclose anything about any particular pattern of perforations that shall be adopted (col. 2 lines 62 to 65, col. 4 lines 36 to 42).

The Examiner's assertion that "*Pfennig et al.'s system is CAPABLE OF producing flow disturbances that undergo mutual destructive interference*" is not supported by any teachings, suggestions or motivations of the reference, but appears to be merely the Examiner's retrospective hindsight reconstruction of the present invention. Moreover, even if the perforation pattern used by Pfennig et al. would have been "capable of" producing flow disturbances with mutual destructive interference, such a "capability" is no substitute for a teaching or suggestion to provide a particular spatial pattern of perforations that actually does create mutual destructive interference of the flow disturbances that are generated by the perforations.

Each of the rejected independent claims 1, 10, 11, 12 and 31 defines features relating to the above-discussed distribution or pattern of the perforations so as to produce the destructive interference of the generated flow disturbances relative to each other. For the above reasons, such features are not anticipated by and would not have been obvious over the Pfennig et al. disclosure. The dependent claims recite additional features that further distinguish the invention over the prior art, for example as follows.

Pfennig et al. have nothing to do with, and provide no disclosures regarding, the features of present claims 2 to 5.

Contrary to present claim 6, Pfennig et al. do not disclose any dimensions of suitable slot-shaped perforations. Contrary to the Examiner's assertion, the slot size cannot be "*merely optimized*" when the reference does not provide any guidance or motivation that the perforation size is even a characteristic that shall be optimized, or what properties can be optimized by changing the perforation size. Particularly, an optimization to achieve mutual destructive interference of the generated flow disturbances would not have been suggested. The Examiner's proposed motivation "*to reduce drag and improve maneuverability*" is not suggested by the reference, but apparently comes only from the Examiner's hindsight reconstruction of the present invention. Also, such a motivation would not have achieved the inventive mutual destructive interference of flow disturbances without a particular (inventive) effort to design the pattern to achieve this.

The particular patterns and structural arrangements according to claims 7 to 9 have no basis in the reference.

The perforation sizes recited in present claims 13 to 15 have no basis in the reference.

The perforation shape, arrangement and patterns defined in claims 16 to 23 have no basis in the reference. The Examiner also has not addressed these features at all.

Claims 26 and 27 expressly recite that the spatial pattern of the perforations has a spatial spectrum that is essentially absent of energy at the selected wavelengths, and that these wavelengths correspond to flow wavelengths of predetermined flow instabilities appearing in the boundary layer airstream. The

Pfennig et al. reference has nothing to do with such features, does not disclose such features, does not necessarily inherently include such features, and would not have provided any motivations in this regard.

For the above reasons, the Examiner is respectfully requested to withdraw the rejection of claims 1 to 23, 25 to 27 and 31 as anticipated by or obvious over Pfennig et al.

9) Referring to the top of page 4 of the Office Action, the rejection of claim 24 as obvious over Pfennig et al. in view of US Patent 2,646,945 (Perry) is respectfully traversed. The Examiner acknowledges that Pfennig et al. do not disclose round holes, but refers to Perry in this regard. Nonetheless, the regular pattern of round holes disclosed by Perry, even when considered in combination with Pfennig et al., would not have provided the features of independent claim 12, from which claim 24 depends. Those features especially relate to the spatial pattern of the perforations so as to cause mutual destructive interference of the flow disturbances caused by the perforations. That would not have followed from Perry. For these reasons, even a combination of the two references would not have made claim 24 obvious. The Examiner is respectfully requested to withdraw the rejection of claim 24.

10) The additional prior art made of record requires no particular comments because it has not been applied against the claims.

11) Favorable reconsideration and allowance of the application, including all present claims 1 to 31, are respectfully requested.

Respectfully submitted,
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